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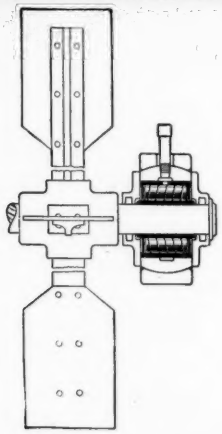

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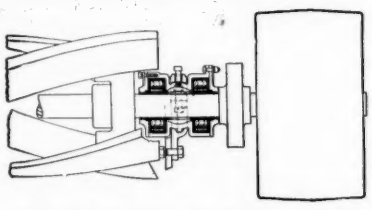

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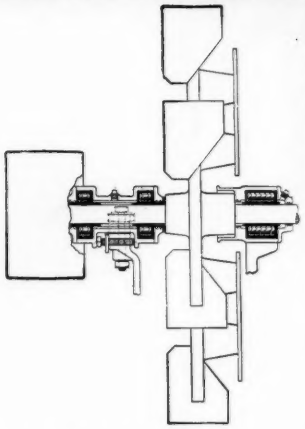

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AGRICULTURAL ENGINEERING

Volume 2 AUGUST, 1921 Number 8

A Comparative Study of Some Insulating Materials

By R. R. Graham, B.A., B.S.A.
Lecturer in Physics, Ontario Agricultural College

BY WAY of introduction I wish to explain what I mean in this case by insulating materials. They are substances or materials which are poor conductors of heat, and those that will be referred to are of a loose nature like shavings and cork clippings. Sometimes these forms of insulation are called "fillers" since they are packed into the spaces between two walls of lumber or other materials.

Low heat conductivity is certainly the most important property of a good insulating material, but there are other properties that are very essential, more particularly from the practical standpoint. What I mean may be more clearly expressed by the statement that all good insulating materials are poor conductors of heat by nature but all nonconductors of heat are not necessarily good insulating materials. One illustration will serve to make this point still clearer. Dry good-quality sawdust is a poorer conductor of heat than planer shavings, but no one who is familiar with the behavior of the two fillers in walls under similar conditions would choose the sawdust in preference to the shavings. The shavings win out under actual tests for several reasons: They are very elastic and, therefore, when once packed into a space maintain their position, whereas sawdust having no elasticity very soon settles and leaves large spaces at the top of the walls for the entrance or exit of heat. Then, again, shavings do not absorb moisture so readily as does sawdust, and as dryness is conducive to low conductivity it is very important that the material be a poor absorber of moisture. Furthermore, shavings can usually be secured in a drier and purer form than sawdust and ,hence, there is less liability to deterioration and decay in the shavings. There are still other differences that might be emphasized, most of them in favor of shavings.

To summarize, a good insulating material has the following properties: Low conductivity of heat, non-absorber of moisture, elastic (if a filler), pure or free from foreign substances subject to decay or spontaneous combustion, and these not mentioned before, namely, not subject to vermin (rats and mice), convenient to handle and install, durable, odorless (if used in construction of cold storages for perishable and easily tainted goods), and reasonably cheap.

For some time I have been very much interested in the subject of insulation, particularly the phase of it enunciated above, as I realized that it was something that would concern the practical farmer more and more as the years go by. Recent applications of insulating materials on farms have confirmed my belief, so I undertook to experiment with several insulating materials, all fillers, in order to ascertain their comparative values as insulators or nonconductors of heat. So far as these experiments have been conducted they show only relative values, not absolute, for the materials tested, but since the question about them from the practical man is usually "Which is the best insulation?" the relative values are the most useful of the two. I had hoped to determine the absolute values before now but sufficient funds and assistance were not available, consequently the work had to be abandoned. The experiments carried out involved a great deal of tedious and painstaking work, but as the results were satisfactory I felt that the task had been worth while. The results in detail would occupy more space than I have at my disposal, and so only a brief description of the method used and a summary of the results obtained with a few comments thereon will be given here.

The method, to describe it briefly, consisted of putting a small metal box containing a known quantity of ice and water in the center of a tight wooden box and filling the intervening space around the inner receptacle with the substance or insulating material that was to be tested, and later determining the amount of ice melted in a given time by the heat that had passed through the material. The tests were made in duplicate for two or three different times with each material tested. The reliability of the method was amply vouched for by the uniformity of results. The two boxes were sealed up tightly while under test. There was always sufficient ice in the inner box to insure a temperature of about freezing, 32 degrees Fahrenheit, throughout the tests, and the room temperature was fairly constant, its temperature being recorded continuously on a self-recording thermometer. The amount of ice (in pounds) melted per hour per one degree Fahrenheit difference between the temperature of ice box and the room was the basis for comparison of the conductivity of the materials tested.

A series of preliminary tests was conducted to find out if the rate of melting of the ice in the inner box depended on the size of the pieces of ice used. As stated above, the cans were filled with pieces of ice and then ice-cold water was added until the cans were completely filled. The tests showed a very slight difference in favor of the melting of the fine pieces of ice. It was eventually determined that if a uniform quality of ice were used and the pieces of ice ranged in diameter from three to five inches and the spaces in the mass of ice were filled with ice-cold water, the meltage was practically a constant factor for any definite temperature. This fact having been definitely decided on, the method already outlined was adopted and a long series of tests with several materials was carried out.

The materials subjected to tests were coarse black gran-

ulated cork, very fine black regranulated cork, 8/20 grade granulated cork of natural color, another grade of granulated cork, natural color, used as packing materials for Malaga grapes, planer shavings, forest leaves, sawdust, chopped straw, and excelsior.

The results showed conclusively that the very fine black regranulated cork is the poorest conductor of heat of all the materials listed above. If we put it at the top of the list and assign it a value of 100, the others occur in the order indicated in the following table:

NAMES OF MATERIALS TESTED	Average Ice in Pounds Melted Per Hour Per 1 Degree F. Difference in Temperature Between Ice Box and Outside Air	Relative Insulating Values, 100 Being the Standard
1. Very fine black re-granulated cork	.00410	100
2. Chopped straw	.00476	86
3. Coarse black re-granulated cork	.0048	85
4. Forest leaves	.0049	84
5. Granulated cork (natural color used for packing material around imported Malaga grapes)	.0049	84
6. 8/20 grade granulated cork (natural color). Looks similar to preceding one but a little coarser in granules and lighter in weight	.0051	80
7. Sawdust	.0060	68
8. Excelsior	.0068	60
9. Planer shavings (loose)	.0068	60
10. Planer shavings (packed)	.0074	55

As I have pointed out, a good practical insulating material must possess other special properties than low conductivity. In reviewing this table then one must bear this fact in mind and not be guided in one's choice of an insulation by conductivity alone. The first one on the list is a very poor conductor of heat because it contains a large percentage of dry air in a quiet condition, but it is black and very dusty, therefore, very disagreeable to handle in any large quantity, and it is also expensive. In my opinion it has no practical value for the farmer. It is better adapted to special lines of insulation in connection with cold-storage construction.

The next, chopped straw, is a good insulation, accessible and cheap on the farm, but unless rats and mice are absolutely prevented from getting into it one could not depend upon it for good results. It has also a tendency to settle in the space it occupies but not so badly as sawdust.

Forest leaves are not very durable as they become disintegrated especially if handled very much. It is very essential that they be dried thoroughly in the sun or in a warm room for some time before using.

Granulated cork, similar to Nos. 5 and 6 in the table, makes excellent fillers, being poor conductors, durable, pleasant to handle, not subject to decay or ravages by rats and mice, and poor absorber of moisture.

Usually sawdust is not pure and dry enough to give good results except in temporary use as packing around ice in ice houses. Other undesirable features of it have been referred to before.

Excelsior is too stringy, hard and stiff, for a good filler. The kind tested was rather coarse. The finer grades would be more satisfactory. It would be difficult to secure it in large quantities.

Planer shavings, although they are at the bottom of the list as nonconductors of heat, make a very satisfactory insulating material for general use as a filler if they are pure, dry, and moderately fine. They are reasonable in cost and quite easy to get.

I would say in summarizing comments on these materials that granulated cork (natural color), planer shavings, and sawdust are the best insulating materials for use on the farm all things considered.

The uses to which these insulating fillers may be put in farm practices are: Packing around beehives for outdoor wintering, protecting water pipes from frost, insulating milk and cream-cooling and water-supply tanks, fillers for refrigerator or small ice-cold storage walls, packing material for fireless cookers, and other uses of minor importance.

Within recent years there has arisen on the farm quite a demand for these insulating materials for the uses just mentioned, particularly for wintering bees outside; granulated cork and planer shavings are used chiefly for this purpose, but some have used leaves, chopped straw, and sawdust with very good results.

One-Third of Irrigation Water Wasted

"I BELIEVE that pipes for the carriage of water will be used to a much greater extent in the future than in the past," says Dr. Samuel Fortier, chief of the irrigation division of the bureau of public works of California. "This applies not only to irrigation, but to all uses to which water is put.

"Man does not carry water to irrigate his crops, it is true. He prefers to tap a stream at the proper height and allow the water to run down by gravity or else he uses some pumping device to raise the water. However, he deserves credit for digging so many ditches. If the main canals and laterals were placed end to end, I suppose they would encircle the globe about eight times. Most of these are still crude and inefficient. About 95 per cent are in earth and the quantity of water absorbed and which percolates through this usually porous material represents over a third of what is admitted through the intake. One of the remedies for this enormous loss of water is a water-tight channel and pipes are the best for this purpose.

"The question then arises, What kind of pipe will be most suitable for these various purposes? In so far as irrigation systems are concerned, I think there is no question that pipe made of good concrete, either plain or reinforced, will more than hold its own with the various other kinds.

"The pressing need at the present time is to save a part of the water which is annually wasted. Of the total area now irrigated, less than 7 per cent have pipes for distributaries, while in other states the ratio between pipes and earthen ditches is very much less. These rough estimates give some idea of the large amount of concrete pipe which is likely to be used not only in the reclamation of new land, but in improving systems already in existence."

Humus and Power

AS STATED by the department of soils of the Ohio State University, organic matter (humus) has many good effects on those properties which go to make up soil tilth. It not only lightens and loosens heavy soils, promoting granulation, improving drainage, and favoring better soil ventilation, but it also makes for easier working of such soil. Attention is called to experiments conducted at the Pennsylvania agricultural experiment station on clay loam where one-fourth less power was required to pull a fourteen-inch plow cutting eight inches deep, on a plot containing sixty-five thousand pounds of organic matter per acre than on a neighboring plot containing only forty-five thousand pounds.

Incorporating humus in loose sandy soils tends to bind the particles together, making them more retentive of water and soluble plant food, less liable to overheat in summer, and also eliminating the danger of blowing so frequently destructive to such soils. Sections which suffer from erosion it is usually found that serious washing does not occur on newly cleared land, but starts in only after several years cropping has destroyed the network of fibrous pea roots and lowers the humus supply of the soil. Humus increases the amount of rainfall which the soil absorbs before surface run-off can start and produce washing.

An Opportunity for Reclamation Engineers

By David P. Weeks

Mem. A.S.A.E. Drainage Engineer, Dakota Engineering Company, Mitchell, South Dakota

SINCE the Reclamation Section of the American Society of Agricultural Engineers has taken form the question has been raised several times as to why it had not been done before. The answer is that the Society is a growing organization well established in its scope of activities but conservative in its program of development.

Response has been received from localities as remote from each other as are San Francisco and New York City, intimating that the Society has been somewhat delinquent in this phase, this very important phase of agricultural engineering. The possibilities of agricultural engineering are very great. It has been wise to develop these possibilities on a firm basis and the full development of the reclamation activities of the Society have been wisely retarded until now, under the organization of a special section, they can be given their due attention and development.

Ten petitioners were required to establish the section and so enthusiastic were the members for its formation that two and three signatures came in where one was expected and more than twenty-five names were on the petition in no time. At the first meeting of the Council after the petition was presented the Reclamation Section was authorized. The approval by the Council of the Constitution prepared for the Section has brought the Reclamation Section into existence, establishing a strong foothold in the Society for the reclamation interests.

Other engineering societies are not giving the attention to drainage, irrigation, and land clearing that they deserve. In an effort to get a comprehensive list of engineers engaged in irrigation for the United States a great deal of correspondence was necessary. As a rule there was not even a list available for the individual states, which would indicate that little organization work has been done in a national way among irrigation engineers. The list of irrigation engineers has passed the three-hundred-and-fifty mark, and when the states of Wyoming, Utah, and Nevada have been heard from our list, which is still incomplete, will be considerably more than four hundred. Announcement of the formation of the Reclamation Section will soon be sent to nearly a thousand reclamation engineers engaged in the various phases of the work.

There are in existence two or three organizations of a national character devoted to popular education and promotion of reclamation interests. Early in the year investigation was made to determine wherein the function of the Reclamation Section might overlap the objects of the National Drainage Congress. It did not seem desirable to establish an organization which might have the same objects in view as a national organization already in existence. A letter from the office of President Perkins of that organization, who is also a member of the American Society of Agricultural Engineers, sets forth the fact that the membership of the National Drainage Congress includes "not only engineers, but drainage commissioners, landowners, farmers, attorneys, machinery and equipment men, and others interested in the development of our resources in overflowed and submerged lands." The objects of the National Drainage Congress as set forth in its constitution and by-laws are largely for popular education and to "provide means for bringing the needs of the people and country before the state and federal government."

The Reclamation Section of the American Society of Agricultural Engineers is an organization of engineers. It has been established to encourage and facilitate conference and deliberation among engineers engaged in land reclamation; to afford opportunity for acquaintanceship and contact between reclamation engineers; to promote investigations and diffuse knowledge concerning the reclamation of agricultural lands by irrigation, drainage, flood control and land clearing, and to encourage and promote by all proper means state and federal legislation for the advancement of land reclamation. The latter might be carried out in cooperation with, rather than in opposition to, the National Drainage Congress.

It must be borne in mind that the Reclamation Section is a technical organization. Its opportunities are unlimited and its duties will multiply as the demands of agriculture increase. Reclamation has its field in the millions of acres of swamp, arid and cut-over lands of the country; but also reclamation is a factor on every farm in the United States regardless of its present state of development. If the farm is flat it needs drainage; if rolling it is in need of protection from soil erosion. Irrigation is moving eastward and drainage is moving westward. The farm that is subject to drought will be irrigated and also drained. Soil moisture control systems will be common to arid and humid sections of the country. It is time that the engineers engaged in the control of soil moisture of the West should begin to compare notes with the engineers engaged in similar work in the East. Two of the most serious problems of reclamation are common to drainage, irrigation, and land clearing. These are organization for development and land settlement. There is an ambition on the part of most engineers to prepare all of the redeemable land for agricultural production. There are limitations to such a program. These limitations are of national character, such as flood control on the larger streams, improvement of navigation, and the conservation of our forests. The extent to which the engineer is or should be interested in reforestation is yet to be determined, but there are certainly some rather nice engineering possibilities along this line. At least there are problems associated with reforestation that the engineer should consider.

The coming annual meeting of the American Society of Agricultural Engineers at Chicago in December will devote a very important part of its program to reclamation. Some of America's greatest reclamation engineers will be there from East and West to discuss those problems which are vital to the full development of this growing subject.

Practical Standardization

THERE is one sort of standardization, the elimination of the unnecessary, which is important. It is a profitable thing not only for the manufacturer and the dealer but should result in lower prices for the consuming public, which otherwise must ultimately bear the expense of storing and manufacturing vast and really unnecessary varieties. A case in point is that of a manufacturer of farm implements who, by making his farm wagon production conform to the conservation schedule, reduced the variety of front and rear gears manufactured in his plant from 1736 to 16.

Some Fundamentals of Stable Ventilation

By Henry Prentiss Armsby and Max Kriss
Director and Associate, Institute of Animal Nutrition of the Pennsylvania State College

(Continued from the July number)

WHILE the general principles of the computation of the fasting katabolism of horses are essentially the same as for cattle, the computation of the heat increment due to the consumption of feed is a much more complicated process. The reason for this lies in the fact that no calorimetric experiments for the direct determination of the heat production and of the balance of energy have been made with horses, and consequently an indirect method of computation of the heat increment has to be resorted to, which involves many estimates and calculations.

From the results of their experiments, Zuntz and Hagemann *(18)*[1] estimate that the metabolizable energy of the feed of a horse equals 1796 calories per pound of digestible nutrients; and they assume, on the basis of Magnus Levy's experiments on man, that 9 per cent of the metabolizable energy of the digestible nutrients consumed by a horse is converted into heat in the process of digestion. They furthermore compute from the results of their own experiments that each pound of total crude fiber consumed increases the heat production by 1202 calories additional, so that the total heat increment due to consumption of feed by the horse is the sum of these two amounts. It is obvious that this method of computation necessitates a knowledge of the digestibility and of the total crude fiber content of the feed.

To illustrate the method of computing the heat increment due to the consumption of feed, that caused by a pound of oats is calculated as follows, the digestible nutrients being those given in Bulletin 186 of the Kansas Experiment Station *(15)*, with the exception of those for clover hay, which are taken from Henry and Morrison's tables *(10)*, from which have also been obtained the data for total crude fiber.

Digestible Nutrients of Oats

Protein	0.107 pound
Carbohydrates	0.503 pound
Fat (3.8 x 2.4)	0.092 pound
Total	0.702 pound
Total crude fiber	0.109 pound

Metabolizable energy
1796 calories × 0.702 = 1260.8 calories

Heat Increment

9 per cent metabolizable energy
1260.8 × 0.09 = 113.5 calories

Additional for crude fiber
1202 × 0.109 = 131.0 calories

Total heat increment 244.5 calories

TABLE IX—Fasting Katabolism of Horses

Live Weight	Fasting Katabolism Per Head Calories	Live Weight	Fasting Katabolism Per Head Calories
150	1160	1000	4100
250	1630	1250	4760
500	2580	1500	5370
750	3390		

The heat increment caused by other feeding stuffs has been computed in a similar manner.

The total heat production of the horse was estimated by Zuntz and Hagemann *(18)* from the respiratory exchange determined by means of a respiration apparatus for short periods after the consumption of different rations. From a comparison of the results and by the indirect method of computing the heat increment due to the work of digestion which has been illustrated they have computed the average fasting katabolism of the horse to be 4,100 calories per 1000 pounds live weight. In proportion to the two-thirds power of the live weight the fasting katabolism of horses, as computed by Armsby, is given in Table IX.

As examples of typical live weights and rations for horses upon which to base the computation of the heat production of these animals the following, suggested, at the request of Mr. Clarkson, by J. L. Edmonds, of the Illinois College of Agriculture have been used.

Daily ration for light horses that get only about enough exercise to keep them in good condition per 1000-pound horse:

8 pounds of oats
2 pounds of wheat bran
10 pounds of timothy hay

Daily ration for 1500-pound geldings at moderate work:

9 pounds of oats
9 pounds of ear corn
7½ pounds of timothy hay
7½ pounds of clover hay

The total heat increment due to the ration fed, computed in the manner described, plus the fasting katabolism of the horse, gives the total heat production of horses of the weights and consuming the rations just specified when performing no work. The heat production is, of course, greatly increased during work, but plainly this additional heat is not ordinarily available as motor power for ventilation.

On the assumption that approximately the same relation exists as in the case of cattle between the total heat emission and the latent heat of water vapor and between the heat and the carbon dioxid produced by horses, a computation was made of the heat given off by radiation and conduction, the latent heat of the water vapor, the amount of water vapor, and the amount of carbon dioxid produced by horses. The method described above for cows was used, and the results are shown in Table XI.

The fasting katabolism of swine has been determined independently by Meissl (16) and by Tangl (17) by starving the experimental animals for comparatively short periods and measuring the katabolism by means of a respiration apparatus. The average of their results, computed per 100 pounds in proportion to the two-thirds power of the live weight, is 1250 calories. The fasting katabolism of swine, computed according to their live weight, is given in Table XII.

The data regarding the increment of heat production

TABLE X—Total Heat Production Per Day and Per Head by Typical Horses at Rest

ANIMAL	Live Weight Pounds	Heat Calories
Light horses	1000	10,853
Heavy work horses	1500	14,835

*Cooperative investigations between the Bureau of Animal Industry of the United States Department of Agriculture and the Institute of Animal Nutrition of the Pennsylvania State College. Reprinted from "Journal of Agricultural Research," Washington, D. C., Vol. XXI, No. 5, June 1, 1921.

[1]Reference is made by numbers in parenthesis to "Literature Cited" on page 177.

TABLE XI—Heat Emission by Radiation and Conduction, Water Vapor and Carbon Dioxid, Produced Per Day and Per Head by Typical Horses at Rest

ANIMAL	Live Weight Pounds	Heat Emission by Radiation and Conduction Calories	Latent Heat of Water Vapor Calories	Amount of Water Vapor Grams	Carbon Dioxid Grams
Light horses	1000	8,140	2713	4622	4341
Heavy work horses	1500	11,126	3709	6319	5934

consequent on the consumption of feed by swine are rather meager. Of these, the results of several investigators on grains and on a mixed ration consisting of rice, flesh meal, and whey, as reported by Armsby *(3, p. 656)*, are considered trustworthy; and the average of these, 417 calories per pound of dry matter eaten, is taken to represent the energy expenditure by swine.

The rations and live weights of the animals, upon which the computation of heat emission by swine has been based, are those furnished at the request of Mr. Clarkson, by Prof. J. M. Evvard of Iowa Experiment Station. The weights of the animals and the daily feed eaten, reduced for convenience to dry matter, and the following:

CLASS	Weight Pounds	Dry Matter of Daily Feed Eaten Pounds
Suckling pig	25	1.29
Weanling pig	50	2.15
Shote, young	100	3.44
Shote, well grown	150	6.02
Fattening hog	200	7.74
Farrowing hog	300	6.88
Breeding gilt	300	3.44
Breeding yearling sow	400	4.30
Breeding old sows, year or over	500	5.16
Breeding boar, young	300	3.44
Breeding boar, yearling	450	5.16
Breeding boar, old	600	6.02

Since 417 calories represent the increment in heat production by swine per pound of dry matter eaten, the heat increment caused by the consumption of feed by swine is computed on the basis of the foregoing estimates by simple multiplication. To this the fasting katabolism of the animal as found in Table XII is added, and the total heat production is thus obtained (Table XIII).

The results of experiments on man *(7)* indicate that the heat emission by radiation and conduction is on the average not far from 75 per cent of the total heat emission, and that the relation of the carbon dioxid production to the total heat production is likewise about the same as in cattle. The apparent agreement of these relationships between two so widely different species leads to the assumption that the results are, at least for this purpose, applicable also to swine. By using, therefore, the method of computation previously described for cattle, the heat emission by radiation and conduction, the latent heat of water vapor, the amount of water vapor, and the amount of carbon dioxid produced by swine are obtained.

No direct determinations of the fasting katabolism of sheep are on record. From the rather scanty data regarding the maintenance ration of sheep available Armsby (3, p. 711) has computed by an indirect method, based on results with cattle, the fasting katabolism of sheep weighing 100 pounds to be 791 calories, and in proportion to the two-thirds power of live weight as given in Table XV.

No determinations of the increment of heat due to the consumption of feed by sheep have been reported, but it appears probable that the results obtained with cattle (Table II) may be applied to sheep without very serious error.

TABLE XII—Fasting Katabolism of Swine

Live Weight Pounds	Fasting Katabolism Per Head Calories	Live Weight Pounds	Fasting Katabolism Per Head Calories
25	496	300	2599
50	786	400	3149
100	1250	450	3406
150	1637	600	4126
200	1984		

The average rations and live weights upon which the computation of the heat emission by sheep is based were taken from several sources. For fattening lambs, the average ration and live weight given by Henry and Morrison *(10, p. 521)* in their summary of the results on sheep of several different experiment stations were used as an example. For breeding ewes, the average ration and live weight given by Hackedorn *(9)* was used. The average ration for maintenance was taken from Bulletin 143 of the Bureau of Animal Industry, United States Department of Agriculture *(2)*, the ration being given in terms of metabolizable energy, which in a maintenance ration also represents the heat production. The respective live weights and rations per head in the two other cases are as follows:

TABLE XIII—Total Heat Production of Typical Swine

ANIMAL	Live Weight Pounds	Total Heat Emission Calories
Suckling pig	25	1034
Weanling pig	50	1684
Shote, young	100	2684
Shote, well grown	150	4147
Fattening hog	200	5211
Farrowing hog	300	5468
Breeding gilt	300	4033
Breeding yearling sow	400	4942
Breeding old sow	500	5806
Breeding boar, young	300	4033
Breeding boar, yearling	450	5658
Breeding boar, old	600	6636

Fattening lambs, average live weight 81.4 pounds—
- Shelled corn, 1.3 pounds
- Alfalfa hay, 1.4 pounds

Breeding ewes, average live weight 90.3 pounds—
- Shelled corn, 0.27 pounds
- Wheat bran, 0.14 pounds
- Linseed meal, 0.05 pounds
- Clover hay, 2.08 pounds
- Silage, 2.09 pounds

By applying to the foregoing rations the estimates and assumptions of the two preceding paragraphs, the total heat emission for sheep may be computed, and from that the heat emission by radiation and conduction, the latent heat of water vapor, the amount of water vapor, and the amount of carbon dioxid produced, exactly as for the other species. The results are as shown in Table XVI.

The method employed by King to compute the rate of air flow for the different species has been given in an earlier paragraph of this paper. It was also shown that, assuming average figures for the percentage of carbon dioxid in the air coming from the lungs and in pure air, respectively, the air flow thus computed corresponds to 0.167 volume per cent of carbon dioxid in the stable air. Taking 0.167 per cent carbon dioxid as a standard, we have computed Table XVII, showing the rate of air flow that will be required to maintain this standard of purity when based on the average computed carbon-dioxid production by the different species in the examples shown in Tables VII, XI, XIV, and XVI. The last

column in the table, giving King's figures for the air flow, has been inserted for the sake of comparison.

A glance at the last two columns of Table XVII reveals that while King's air flow for cows agrees fairly well with that computed from the carbon dioxid produced, those for other species differ very widely. In other words, either King's figures for volume of respiration in other species than cattle are too high or his assumption of a uniform percentage of carbon dioxid in the expired air is erroneous. At any rate, the actual carbon-dioxid production would seem to be the proper basis upon which to estimate the rate of ventilation required.

As already shown, a considerable part of the motive power for stable ventilation is derived from the heat eliminated by the animals, and this heat is also depended upon to maintain the proper temperature in the stable. Obviously, the difference in temperature that can be maintained between the stable air and that outside depends, other things being equal, upon the balance between heat production and heat loss in ventilation. The maximum value of this difference can be computed, when the rate of the air flow and the heat production values are known, on the assumption that no heat is lost by radiation through the walls of the stable. It should, however, be borne in mind that it is only the heat eliminated by radiation and conduction that should be made the basis of the computation, since the latent heat of water vapor, as already explained, is not available for this purpose.

Assuming for the purpose of illustration an air movement corresponding on the one hand to King's standard and on the other hand to the amounts computed in Table XVII from the carbon-dioxid production, the temperature difference that can be maintained by the different animals can be determined in the following manner: One calorie of heat can raise the temperature of a pound of water about 4 degrees Fahrenheit. Since the specific heat of air is 0.237 and since 100 cubic feet of air weigh 8 pounds, one calorie of heat can raise the temperature of 100 cubic feet of air

$$\frac{4}{0.237 \times 8}$$, or 2.1 degrees.

TABLE XIV—Heat Emission by Radiation and Conduction, Water Vapor, and Carbon Dioxid Product by Typical Swine Per Day and Per Head

Animal	Live Weight Pounds	Heat Emission by Radiation and Conduction Calories	Latent Heat of Water Vapor Calories	Amount of Water Vapor Grams	Carbon Dioxid Grams
Suckling pig	25	776	259	441	414
Weanling pig	50	1263	421	717	674
Shote, young	100	2013	671	1143	1074
Shote, well grown	150	3110	1037	1767	1659
Fattening hog	200	3908	1303	2220	2084
Farrowing hog	300	4104	1367	2329	2187
Breeding gilt	300	3025	1008	1717	1613
Breeding yearling sow	400	3707	1235	2104	1977
Breeding old sow	500	4355	1451	2472	2322
Breeding boar, young	300	3025	1008	1717	1613
Breeding boar, yearling	450	4169	1389	2366	2223
Breeding boar, old	600	4977	1659	2826	2654

TABLE XV—Fasting Katabolism of Sheep

Live Weight Pounds	Fasting Katabolism Per Head Calories	Live Weight Pounds	Fasting Katabolism Per Head Calories
20	270	120	890
40	430	140	990
60	560	160	1090
80	680	180	1170
100	791	200	1250

Consequently, the heat required to warm by one degree the daily volume of air per head required by King's standard or that computed in Table XVII from the carbon-dioxid production is:

Species	By King's Standard Calories	By Our Estimates Calories
Cows	405	394
Horses	492	264
Swine	159	88
Sheep	104	38

Supposing now that all the heat eliminated by the animals by radiation and conduction is imparted to the air passing into and out of the stable—that is, assuming that no heat is lost by radiation through the walls of the stable—this heat is capable of maintaining a temperature difference in degrees Fahrenheit equal to the daily heat emission per head by radiation and conduction divided by the figures of the foregoing table.

By the method just described and by the use of the corresponding heat elimination values a calculation has been made of the maximum average difference in temperature between the stable and the outside air that can be maintained by the animal when King's (14) standards for ventilation or those computed from the carbon-dioxid production in Table XVII are used. This calculation is given in Table XVIII.

On the basis of the average figures for the temperature difference given above, Table XIX has been computed, showing approximately the temperature of the stable when air enters at different temperatures, first, at the rate recommended by King, and, second, at the rate computed by the writers (Table XVII, columns 6 and 5, respectively).

This tale is interesting in that it shows approximately the point at which the heat supplied by the animals becomes deficient for maintaining the proper temperature in the stable. Thus, when King's standard of air flow is taken as the minimum, the heat supplied by cows appears to become deficient for maintaining what is believed to be the best stable temperature when the outside temperature is below 15-degrees Fahrenheit. The heat supplied by horses, swine, and sheep appears to become deficient at a much higher outside temperature. When, however, the rate of air flow computed from the carbon-dioxid production is made the basis of the computation, the difference between the species disappear.

Conversely, the same data may be used to compute the maximum rate of air flow compatible with the maintenance of a given temperature difference between the stable and the air outside—for example, a stable temperature of 50 degrees Fahrenheit in zero weather—since it is evident that if the air flow be reduced the temperature difference and consequently the efficiency of the animals to warm the stable will be increased, while if the ventilation be increased the contrary will be the case. To illustrate this point Table XX has

TABLE XVI Heat Emission, Water Vapor, and Carbon Dioxid Produced by Typical Sheep Per Day and Per Head

Animal	Average Live Weight Pounds	Total Heat Emission Calories	Heat Emission by Radiation and Conduction Calories	Latent Heat of Water Vapor Calories	Water Vapor Grams	Carbon Dioxid Grams
Fattening lambs	81.4	2044	1533	511	871	818
Breeding ewes	90.3	2021	1516	505	860	808
Sheep on maintenance	100.0	1483	1112	371	632	593

TABLE XVII—Air Flow Per Head to Maintain 0.167 Per Cent Carbon Dioxid

SPECIES	Carbon Dioxid Produced Per Day Grams	Carbon Dioxid Produced Per Day Cu. ft.	Air Flow Per Day Cu. ft.	Air Flow Per Hour Cu. ft.	Air Flow Per Hour According to King Cu. ft.
Cows	[1]7686	138.348	82,843	3452	3545
Horses	5138	92.484	55,379	2307	4303
Swine	1708	30.744	18,410	767	1394
Sheep	740	13.320	7,976	332	909

[1]Average carbon dioxid production by cows in milk.

been computed, showing what rate of air movement would be required if it were desired to maintain a temperature difference of 50 degrees between the stable and the outside air. It should be noted that, as in Tables XVIII and XIX, these are maximum values, since no allowance is made for losses through the stable walls.

The results recorded in Table XX are notably lower than the minimum air flow computed in Table XVII as necessary to maintain the carbon-dioxid content of the stable air at 0.167 per cent and still further below the rate of air flow recommended by King. In other words, (at least in the specific cases used as examples) it will be necessary in severe weather to restrict the ventilation in order to conserve heat and maintain a desirable stable temperature, and consequently the stable air will fall below King's standard of purity, namely, 0.167 per cent of carbon dioxid. The writers are not acquainted with any investigations upon the effects of a higher percentage of carbon dioxid upon animals during long periods, but in experiments with the respiration calorimeter this limit has frequently been exceeded in two-day trials with no obvious ill effects.

Evidently there is a certain degree of discrepancy between King's requirements and the results of our computations. As has been mentioned on previous pages, the amount of carbon dioxid produced by animals is approximately proportional to their heat production, so that the rate of ventilation should also be approximately proportional to the heat production in order to maintain any desired standard or purity in the air of the stable. It is true that the heat production of animals may vary widely, but to the extent to which the examples we have used may be regarded as typical it appears that the accepted ventilation requirements for the different species are not proportional to their heat production. Taking the values for cows as unity, the relative computed heat production and King's relative ventilation requirements are approximately as follows:

TABLE XIX Temperature in Stable as Compared With That Outside Temperature of Air in Stable

Temperature of Outside Air Degrees F.	Corresponding to King's Figures for Ventilation: Cow Degrees F.	Horse Degrees F.	Swine Degrees F.	Sheep Degrees F.	Corresponding To Air Flow Given in Table XVII, Column 5 All Species Degrees F.
—20	15.6	0.4	0.1	—6.7	16.5
—10	25.6	9.6	10.1	3.3	26.5
0	35.6	19.6	20.1	13.3	36.5
10	45.6	29.6	30.1	23.3	46.5
15	50.6	34.6	35.1	28.3	51.5
20	55.6	39.6	40.1	33.3	56.5
25	60.6	44.6	45.1	38.3	61.5
30	65.6	49.6	50.1	43.3	66.5
35	70.6	54.6	55.1	48.3	71.5

TABLE XX—Maximum Rate of Air Flow Possible if a Temperature Difference of 50 Degrees Fahrenheit is to be Maintained

SPECIES	Average Live Weight Pourds	Air Flow Per Day Per Head Cu. ft.	Air Flow Per Hour Per Head Cu. ft.
Cows	1075	60,530	2522
Horses	1250	40,459	1686
Swine	280	13,453	561
Sheep	91	5,825	243

TABLE XVIII—Average Temperature Difference Maintained by Animals

SPECIES	Average Live Weight Pounds	Average Temperature Difference Corresponding to Air Flow Computed by King Degrees F.	Average Temperature Difference Corresponding to Air Flow Computed from Carbon Dioxid Production Degrees F.
Cows[1]	1075	35.6	36.58
Horses	1250	19.6	36.49
Swine	280	20.0	36.40
Sheep	91	13.3	36.50

[1]The average heat emission by radiation and conduction by cows in milk were used for the computation.

ANIMAL	Relative Heat Production	Relative Air Movement
Cows	1.0	1.0
Heavy horses	.8	1.2
Swine	.2	.4
Sheep	.1	.3

Too much stress should not be laid on these differences in view of the paucity of data for other species than cattle, but they indicate clearly the need for further fundamental investigation.

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Agricultural Engineering Development

A Review of the Activities and Recent Progress in the Field of Agricultural Engineering Investigation, Experimentation and Research

Edited by R. W. Trullinger

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LAND CLEARING AND WOOD UTILIZATION BY DISTILLATION, W. R. James (Hercules Powder Company, Wilmington, Delaware, (1920) pp. (1) + 32, pls. 6). This is a paper delivered at the Agricultural Extension Directors Convention at Gulfport, Mississippi, December 18, 1919, in which an experiment on clearing twenty-five acres of cut-over, long-leaf-pine land and the destructive distillation of stumps is reported. Tables of data and cost analysis are also included.

The tract selected was of fairly average condition and the stumps ranged from six to fifteen years in age. The stumps were removed with dynamite at a total cost per acre varying from $22.14 to $41.39. While the average of these figures is not considered a true indication of the average cost of clearing such lands in general, it is noted that the cost per ton of wood recovered was lowest on the land costing the most to clear. It is also noted that in shooting long-leaf-pine stumps the character of the soil did not affect the cost vitally because the charge of explosive was confined within the root.

A small sized horizontal retort was used for the distillation. The products of distillation of these stumps were charcoal, tar and so-called mixed tar oils. The cost of equipment and construction was $4046.82. Considering total operating costs, interest, depreciation, repairs, supplies, and labor, the profit per acre on a 24-hour operating schedule was $12.33 and on a 36-hour schedule $12.81.

While the plant used proves to be slightly too small, it is concluded that destructive distillation offers great possibilities for anyone who contemplates clearing long-leaf-pine lands on a fairly large scale. "Generally speaking, a man would hardly employ the distillation process on less than 1,000 acres, even though....it might be possible to make a profit by using 500 acres, and doubling the depreciation figures."

ROADS AND LOADS, R. C. Barnett (New York National Automobile Chamber of Commerce, Inc., Motor Truc' Committee, 1920, pp. (15) fig. 10). An analysis of factors determining the load which a motor truck will haul on different grades and over various kinds of road surfaces is presented, based on empirical and other data derived from experimental work by the author and others.

In the analysis of tractive effort, preliminary experiments were conducted to determine the coefficient of friction of rubber tires on different kinds of pavement. The apparatus used consisted of a sled having its runners shod with pieces of old rubber tires and a spring balance for measuring the horizontal force necessary to pull the sled along the pavement. The horizontal force was divided by the weight on the runners to give the desired coefficients. The following coefficients of friction were obtained: Dusty water-bound macadam 0.53, gritty water-bound macadam 0.545, dry-packed cinders 0.56, moist sand 0.64, dry dirt 0.51, dry oiled macadam 0.79, dry bituminous macadam 0.87, wet bituminous macadam 0.74; dry concrete 0.925, wet concrete 0.82, and dry monolithic brick 0.77. It is shown that tractive effort is dependent on and limited by the friction between tires and pavement, is dependent on the amount of torque that can be delivered to the drivers, and bears a definite relation to the speed of the truck and the horsepower of the engine.

Data from different sources is also given on the tractive resistance of different pavements and the final formula for total resistance to motion on different grades derived. From this the following general formula for permissible truck load is derived:

$$W = \frac{1}{\left(\frac{t\cos\alpha}{2000} + \frac{\sin\alpha}{\quad}\right)} \left(\frac{375\ BHP \times f - .005M^2A}{M}\right)$$

in which W is the total load in pounds, α is the angle of the grade, t is the unit of tractive resistance, BHP is the brake horsepower of the engine, f is the transmission efficiency factor, M is the speed in miles per hour, and A is the area of exposed surfaces normal to motion in square feet. Graphic data covering a wide application of the above are included.

SEWAGE DISPOSAL FOR THE ISOLATED DWELLING AND SMALL INSTITUTION, R. B. Wiley (Purdue University Engineering Experiment Station Bulletin 6 (1920), pp. 36, figs. 15, LaFayette, Indiana). This is a semi-technical bulletin giving information on the planning and construction of sewage-disposal systems for isolated and rural residences and institutions.

The methods described consist essentially of preliminary treatment in a septic or Imhoff tank and final treatment by aeration in a stream, in soil, or on a contact sprinkling or sand filter. It is stated that the dry method of sewage disposal is very unsatisfactory and should be avoided wherever possible. Disposal by dilution is also considered inadvisable unless there is a continuous flow of at least five thousand gallons of water per capita per day. Tank treatment and aeration are considered to be fundamentally complementary. A properly designed septic tank should remove about fifty per cent of the solids and about fifty per cent of the bacteria present in the fresh sewage. The Imhoff tank gives a better effluent than the septic tank and the sludge is more easily disposed of. In general, if the number of people to be served is more than twenty, the Imhoff tank should be used. The use of cesspools is condemned.

The importance of engineering advice in the design of sewage-disposal systems where absolute purification is imperative is emphasized.

While the results reported in this bulletin are not new they are based on studies in progress at the station, the purpose of which is to develop rational basic principles of design.

CEMENT PLASTER LINING FOR WOOD IRRIGATION FLUMES, E. N. Byran (*Engineering News-Record*, 85 (1920). No. 23, pp. 1090-1092, Fig. 1, New York). Experiments on three flumes aggregating 1560 feet indicate that cement plaster lining may be successfully and more cheaply used for waterproofing than all wood construction. The plaster used was composed of one part cement and three parts sand, and dry hydrated lime equivalent by weight to ten per cent of the cement. The flumes were constructed with box siding and flooring of one-inch No. 2 Oregon pine lumber to which was applied a lining of plaster one inch in thickness. It was found that the annual maintenance cost was also less than for a wooden box flume. No matter how long the water is out of the plaster-lined flume it may be safely turned back without extensive repairs.

EFFECT OF STORAGE OF CEMENT, D. A. Abrams, Lewis Institute, Chicago, Structural Materials Research Laboratory Bulletin 6(1920) pp. 28, figs. 10). Tests on the effect of storage for periods up to two years of three different lots of Portland cement in different kinds of packages and under different conditions on its concrete and mortar-making properties are reported.

The cements were stored (1) in the laboratory, (2) in the basement of the building, and (3) in a shed in the yard, usually in lots of from eight to twelve hundred pounds in standard cloth sacks. In one group of tests two brands of paper sacks were also used, and in another group the cloth sack containers were covered with thin layers of either Portland cement or hydrated lime. Tests were made at ages of seven and twenty-eight days, three months, and one and two years on samples taken immediately upon receipt from the dealers' warehouses and after storage for three and six months and one and two years.

The report includes the results of compression tests of about one thousand 6-by-12-inch cylinders, about one thousand 2-by-4-inch cylinders of 1:3 standard sand mortar, and about five hundred miscellaneous tests. Tests have been under way for three and a half years. It was found that there was no essential discrepancy between the results of compression tests of 1:5 concrete in the form of 6-by-12-inch cylinders and those of tests on 1:3 standard Ottawa sand mortar in 2-by-4-inch cylinders. Compression tests of concrete and mortar showed a deterioration in strength with storage of cement for all samples, for all conditions and periods of storage, and at all test ages. The deterioration was greatest for the samples stored in the shed in the yard and least for the samples stored in the laboratory. The basement storage was nearly as severe as that outdoors. The deterioration was greater during the first three months than for the later three-month periods. A greater deterioration was found in the tests made at the age of seven days than at twenty-eight days and later test ages. After three-months storage in the shed in the yard, the cement had eighty per cent of its original strength; after six-months storage, seventy-one per cent; after one-year storage sixty-one per cent; and after two-year storage forty per cent.

The deterioration was probably greater in these tests than would be found in a larger lot of cement stored under similar conditions.

The effect of storage of cement on the concrete or mortar strength is largely a question of the age at which concrete or mortar is tested. The average concrete strength of cement stored in the shed in the yard when tested at seven days (for all periods of storage) is sixty-four per cent of the strength when received from the warehouse; at twenty-eight days, seventy-one per cent; at six months seventy-eight per cent, at one year eighty-two per cent; and at two years eighty-five per cent. A somewhat similar relation is found for other storage conditions. It is considered a matter of the utmost importance to note that the strength of concrete is not permanently reduced to the low values found in the seven and twenty-eight-day tests.

For periods up to one and one-half years there was no marked difference in the quality of cement stored in cloth and in paper sacks. The two brands of paper sacks gave almost identical results. Only a slight advantage was found from the protection of cement in cloth sacks which were covered by thin layers of Portland cement or hydrated lime.

The most favorable storage condition (in laboratory) and the least favorable (in the basement and shed) gave strengths of the same order of magnitude, indicating that the possibilities of improving the storage condition of cement in sacks in this climate is rather limited. Storage of cement prolonged the time of initial and final setting, but only slightly affected the normal consistency. The deterioration of cement in storage appears to be due to absorption of atmospheric moisture, causing a partial hydration, which exhibits itself in reducing the early strength of the concrete and in prolonging the time of setting.

Only a negligible quantity of lumps were formed up to one year's storage. Tests on concrete using only broken lumps of cement gave considerable strength.

Brief discussions of storage of cement on the work and a bibliography on the effect of storage of cement are given.

REVIEW OF MECHANICAL CULTIVATION, M. Ringelmann (Bulletin Societe Encouragement Industrie Nationale, Paris, 117(19—) II, No. 5, pp. 275-297, figs. 14). A review is given of different experiments, conducted in France during 1917, on various aspects of mechanical cultivation. Attention is called particularly to experiments on vine cultivation in different localities, in one case using a 10-20 horsepower tractor. On vines and cereal crops it was found that the tractor with two men and a three-furrow plow did as much work as five teams and five drivers in the same time. The conclusion is drawn that any tractor having an axle length equal to the distance between the vines minus 50 centimeters can be used. It was found that the machine used turned easily on a headland from 4½ to 5 meters wide. Special attention is called to the importance in purchasing a tractor of seeing that any accessories projecting beyond the line of the wheels will allow the tractor to pass between the vines.

Further experiments on the estimation of the work of a power-farming machine led to the deduction of the formula: $s = Klc$, in which s is the surface plowed, l is the width of plowing, and c the distance traveled per unit of time; K is a coefficient covering losses in time. It varies from 0.64 to 0.71, with respective speeds forward during work of 1½ and 0.8 meters per second.

Further experiments on reddish sand and silt soils almost entirely lacking in lime showed that where the soil conditions were good a cylindrical moldboard plow required an average traction of 6.4 pounds per square inch, while a disk plow required an average traction of but 4.2 pounds per square inch, giving an economy over the moldboard plow of about 38 per cent. In dry weather it was found that ordinary plows will penetrate these pebbly heavy soils with difficulty and the shares are quickly ruined, but if sufficiently heavy a disk plow will always penetrate. If the soil is wet, the share penetrates easily, whereas the disk plow kneads the soil-like mortar, doing damage. The disk plow, however, is considered generally preferable to the moldboard plow.

A. S. A. E. and Related Activities

Nomination Committee Report

THE NOMINATION committee of the American Society of Agricultural Engineers, consisting of K. J. T. Ekblaw, chairman, Emory S. Fowler, and V. V. Detwiler, have submitted their report on the nomination of officers for the year 1922, in which is presented the names of the following candidates eligible for election to the respective offices:

President.....A. J. R. Curtis
First vice-president.....G. W. McCuen
Second vice-president.....David P. Weeks
Treasurer.....Frank P. Hanson

Councillor (One to be elected)
Wm. Aitkenhead
Geo. W. Iverson
W. G. Kaiser

Nominating Committee (Three to be elected)
W. G. Kaiser
G. B. Gunlogson
O. W. Sjogren
W. B. Jones
H. E. Roethe
P. S. Rose

College Section Nominations

THE nominating committee of the College Section of the American Society of Agricultural Engineers, consisting of H. H. Musselman, chairman, Daniels Scoates, and L. J. Fletcher, has submitted the following nominations for the advisory council of the College Section for ballot by the members of the Section: Council members for two years (two to be elected)

Daniels Scoates
R. W. Trullinger
F. W. Ives
J. B. Davidson
E. R. Jones

Council members for one year (two to be elected)
W. J. Gilmor
H. H. Musselman
R. B. Gray
E. R. Gross
H. E. Murdock

N.I.V.A. Appoints Advisory Committee on Standardization

RESPONDING to Secretary of Commerce Hoover's recent request that the National Implement & Vehicle Association appoint an advisory committee on standardization of farm equipment, President W. H. Stackhouse of that organization has appointed a committee of twelve to serve as the contact body. It is expected that this committee, whose personnel represents many farm equipment lines, will be called from time to time to confer with Secretary Hoover or his subordinates regarding recommendations which he may see fit to make regarding further standardization of farm equipment.

The members of this general standardization committee are as follows:

Chairman, G. W. Crampton, Deere & Company.

Members at Large; H. B. Dinneen, Moline Plow Company; F. M. White, Emerson-Brantingham Implement Company; and E. A. Johnston, International Harvester Company.

Department Members: J. B. Bartholomew, Avery Company, representing the tractor and thresher department; B. B. Bell, Hunt-Helm & Ferris Company, representing the barn equipment department; Arthur Johnson, International Harvester Company, representing the ensilage machinery department; E. E. Parsonage, Deere & Company, representing the farm wagon department; F. H. Clausen, Van Brunt Manufacturing Company, representing the grain drill and seeder department; B. J. Kough, Deere & Company, representing the plow and tillage implement department; F. P. Cory, McClure Company, representing the silo department; and O. W. Johnson, Ward-Love Pump Corporation, representing the sprayer department.

Hoover Advocates Fall Road Contracts

AFTER a thorough study of the matter in consultation with representatives of the various national engineering societies, most of them members of the Federated American Engineering Societies, Herbert Hoover, Secretary of Commerce, has placed his influence behind the movement toward the letting of highway construction contracts in the fall, as is evidenced by his letter commending the plan to the governors of the various states.

Probably the outstanding reason for giving the matter his attention at this particular time is the promise the proposal gives of relieving in some measure the unemployment situation, but there appears to be in the plan a number of fundamental advantages from the standpoint of both engineering and public policy. It is pointed out that fall letting would bring about a longer construction season amounting, in the Middle West to about forty per cent more time for both grading and concreting. This increase in the length of the construction season will have advantages in providing for more nearly continuous employment of labor, greater progress each season, less fluctuation in construction, and better car service in the shipment of material.

The second main advantage of the proposal lies in the opportunity for interseasonal work, of which the outstanding feature would be the employment of part of the construction labor throughout the year. It is estimated that under the most efficient management provided that the contractors know in the fall or early winter what work they will have to do the following year, twenty to twenty-five per cent of the men now hired in the spring and laid off in the fall could be given employment through the winter as well. It is particularly to be noted that the more continuous employment is not limited to the contractors employes, who would be engaged in repairing, transporting and locating equipment in preparation for the active season, stock piling of materials, doing heavy grading, etc., but would extend to the basic industries supplying the materials and equipment which under the present program of road building are used in large quantities. In fact it should be considered that road building carries with it the whole group of related industries to a greater or less extent. In this connection railway transportation should be mentioned particularly.

Administrative and other overhead expense which is approximately a fixed amount regardless of the length of season in all of these industries as well as in contracting would be distributed over a longer period and a higher unit production, with consequently reduced cost of production which ultimately will work out in reduced cost per mile of highway.

The relation of road building policy to railway problems is so intimate and important as to call for special attention. In the past road building progress has been impeded seriously and costs run up unnecessarily by the inability of the railroads to haul the required amount of materials in the short period of peak demand following the letting of contracts in the spring and the frenzied scramble of contractors to get materials on the ground and the work completed in the short season remaining. Not only would the earlier letting of contracts and the earlier beginning of such work move the peak of road material transportation away from the general summer transportation peak but will reduce the severity of the road material transportation peak by spreading this hauling throughout the year to just the extent the stock piling would go on during the winter. While there may be at the present time no difficulty in securing freight cars, it is a matter of accepted fact that a return to approximately normal conditions would put the railroads in a position where they could take care of business only by having it distributed uniformly throughout the twelve months of the year.

There are a number of objections to the proposal, the most important one being the doubtful wisdom of contracting for roads considerably in advance of the bulk of their construction during price and cost fluctuations, particularly in a period of receding prices. In the simplest terms the bulk of the opposition to fall letting is found in the hope that better bids may be secured by waiting until the last moment. This view is offset, to some extent at least, by the belief in some quarters that prices will begin to swing upward in the near future. It is believed that the various objections can be met satisfactorily by certain modifications of contracts to take care of the points involved, including not only price fluctuations, but also the making of payments to contractors as soon as they get materials on the ground thereby preventing the program from being nullified by the problem of financing.

The American Society of Agricultural Engineers joins with other engineering bodies and the Secretary of Commerce in believing that the plan as proposed will go toward relieving the present and immediate problem, as well as reducing seasonal waste and promoting the cause of better roads for less money. It is suggested that members individually make use of every opportunity to exercise their influence in behalf of the plan.

Better Farm Home Competition

THE State College of Washington, at Pullman, in cooperation with the American Institute of Architects held a better farm home competition which closed April 15, 1921. This project was inaugurated at the instigation of Prof. L. J. Smith, head of the department of agricultural engineering.

Prof. Smith, profiting by experience in a similar competition at the Manitoba Agricultural College, divided the Washington competition into three groups, as he had found that otherwise a sufficient number of plans for very small homes as not secured, and plans for this sort of home were desired since they are needed by young farmers settling on new farms, also as homes for married hired men. The three groups were: three or four-room farm bungalows; five, six and seven-room farm bungalows; and two story farm houses of seven or eight rooms. In none of the groups were the bathrooms or men's wash rooms to be counted in the number of rooms.

The competition was entered by a little over one hundred farm women, only women having had farm experience being eligible. Something over three hundred plans were submitted, distributed about equally among the three groups. A number of business firms interested in building materials and home furnishings contributed, either in money or merchandise, a sufficient number of twenty-five-dollar prizes so that there were two or three for each group.

The Washington state chapter of the American Institute of Architects cooperated with the college, a number of its members giving their services to redraw the plans and design appropriate elevations and details. In performing this professional service the essential details specified by the competitors were not changed. The judges, in addition to Prof. Smith, were Prof. Rudolph Weaver of the department of architecture, and Miss M. Minerva Lawrence of the extension service of the college.

It is understood that the prize plans, together with a number of other meritorious plans falling outside the prize list, are to be published in bulletin form and that complete architectural drawings and specifications will be available for the use of the public at a slight charge.

Personal Items of Members

J. D. CHAPPELL has joined the The Thomas Cusack Company, outdoor advertising, as sales manager. Mr. Chappell was for more than two years general sales manager of the General Ordnance Company. He was formerly connected with the DeLaval Separator Company and the Studebaker Corporation.

MARK HAVENHILL, formerly connected with the Cleveland Tractor Company, became associated on July 1 with the Kansas State Agricultural College, Manhattan, Kansas, as rural extension engineer.

E. W. LEHMANN has been appointed head of the farm mechanics department at the University of Illinois. Prof. Lehmann is a graduate in agricultural engineering from Iowa State College. For a time he was professor of farm engineering at the University of Missouri and late agricultural engineering editor of "Successful Farming."

More recently he has been extension agricultural engineer at the University of Missouri.

L. R. VAN VALKENBURG has resigned as head of the service department of the Avery Company to engage in business for himself in the Northwest.

ARTHUR W. WILSON, until recently advertising manager of the Hercules Powder Company, has become affiliated with Stroud & Brown, Incorporated, advertising and merchandising agents, located at 303 Fifth Avenue, New York City, as manager of the agricultural department.

F. A. WIRT, who recently severed his connection with the Harrisburg (Pennsylvania) branch of the Emersom-Brantingham Implement Company, has been appointed head of the department of farm machinery in the college of agriculture at the University of Arkansas. At the present time he is in charge of a number of farm buildings undergoing construction on the new 400-acre university farm recently purchased.

Necrology

EDMUND TAYLOR PERKINS

IN THE sudden death of Edmund Taylor Perkins, who died suddenly on May 21, 1921, in Chicago, the engineering profession loses a man widely known and respected both through his personal relations and through his numerous professional and other connections, and the Agricultural Society of Agricultural Engineers loses a valuable member.

He was born in Scottsville, Virginia, September 8, 1864, and was graduated from Union College, Schenectady, New York in 1885 taking degrees of A. B. and C. E. followed in 1888 with the M. A. degree. From 1885 to 1902 he was in the service of the U. S. Geological Survey, later with the U. S. Reclamation Service doing stream gauging and runoff determination in Colorado, followed by work on the Yuma irrigation project in Arizona. Other activities and connections include the general inspectorship of the Chicago Transportation and Contracting Office, member of the Everglades Engineering Commission of the State of Florida, engineer for the Green Bay Levee and Drainage District No. 2 of Lee County, Iowa, the South Quincy and Valley City Drainage Districts of Illinois, the Marion County Drainage District of Missouri, and consulting engineer for a number of drainage districts in Arkansas.

In 1910 he founded the Edmund T. Perkins Engineering Company, First National Bank Building, Chicago. In his consulting work, he gave particular attention to land drainage, reclamation and sanitation. One of his last engagements was a two-months' trip to Colombia, South America, to investigate and report on the natural resources of that country.

Mr. Perkins was prominent in the work of the American Association of Engineers, having been at one time its president and being at the time of his death a member of its board of directors. He also was at that time president of the National Drainage Congress, and is given credit for its origin. Organizations of which he was a member include in addition to those mentioned, The Illinois Society of Engineers, the Western Society of Engineers, the American Society of Civil Engineers, the Engineers Club of Chicago and New York, the Mississippi Valley Association and the Chicago Association of Commerce. He belonged also to the University, Iroquois, and Glen View clubs of Chicago, and the Chevy Chase Club of Maryland.

Conference of Secretaries of National Standardizing Bodies

THE Secretary of the American Engineering Standards Committee, Dr. P. G. Agnew, has just returned from a short trip to Europe to attend a conference in London of the secretaries of the national standardizing bodies. After the conference he visited France, Switzerland, and Germany for a more detailed study of the standardization work in those countries.

The conference, which was called by the Secretary of the British Engineering Standards Association, C. le Maistre, had for its object an interchange of experience and the furtherance of cooperation between the various national bodies in their work of industrial and engineering standardization.

It is interesting that, notwithstanding great differences in the details of procedure, the same general method of work is followed in the different countries, namely, technical decisions concerning any specific piece of work are in the hands of a working committee which is so constituted as to be broadly representative, from both the technical and the managerial points of view, of the particular branch of the national industry concerned. This same general method is followed whether the work is of the nature of specifications, methods of test, or dimensional standardization.

The secretaries will submit the suggestions of the conference to their respective organizations for approval. These have to do with the interchange of publications, a reciprocal arrangement for making foreign standards available to the industries of each country through their sales by the offices of the national bodies, the exchange of information as to the status of work in progress, and other methods of furthering cooperation between the national bodies.

It was the view of the conference that international cooperation in industrial standardization work should proceed along such informal lines being based primarily upon the interchange of information on active subjects of mutual interest, rather than by any attempt at the present time to form a general international standardizing body; that in cases in which formal organization should be found necessary, the organization should preferably be by subject or industry, somewhat along the lines of the International Electrotechnical Commission; but that in all cases efforts should first be made to secure results by less formal methods; and to this end it would often be desirable that in a given subject, the office of one of the national bodies most interested should, by informal agreement, perform such secretarial functions as would further international agreement in the particular subject.

Arrangements are being made for close cooperation between the national standardizing bodies and the International Chamber of Commerce, which will give special consideration to the subject of standardization at its convention in London the week of June 27, and has organized a committee to develop interest in the subject on the part of industrial and commercial interests, and for the diffusion of information on standardization. It is the policy of the International Chamber of Commerce to further the standardization movement by such means, considering only the more general aspects of the problem, and the policies to be followed, leaving the details of industrial standardization to the national bodies, who will cooperate directly with the national organizations of the International Chamber of Commerce in their respective countries.

It was felt by all concerned that the conference was a very successful one, and that it constituted an important forward step in establishing a closer relationship and understanding between the various national bodies.

The secretaries present were: Belgium, G. Gerard; Canada, R. J. Durley; Great Britain, C. le Maistre, C. B. E.; Holland, E. Hijmans; Norway, A. Eriksen; Switzerland, M. Zollinger; U. S. A., P. G. Agnew.

Congress of Mechanical Engineers Under Way

ON MAY 6th at the Machinery Club, New York City, occurred a meeting of twenty-four men representing various engineering and technical societies to consider the desirability of and formulate plans for a congress of mechanical engineers to be held some time in the fall. The American Society of Agricultural Engineers was represented by Edward P. Stahl.

Calvin W. Rice, representing the American Society of Mechanical Engineers, explained that the use of the term mechanical was not intended to be in any wise exclusive of engineers from other societies but was adopted simply as the most nearly descriptive term, since all industries are mainly mechanical in their processes. After election of Dr. H. S. Person, managing director of the Taylor Society as chairman and W. Herman Greul of the National Industrial Conference Board as secretary, the occasion for the meeting and the proposed congress was presented by L. P. Alford of the American Society of Mechanical Engineers. He touched upon the formation of the Federation of American Engineering Societies

and of the program of the Federation for the elimination of waste in industry, and how the Federation realized the need for education, but was obliged to drop it from its program owing to the pressure of other matters. It was suggested that they leave this very important and large problem to some other organization, and it is to meet this need that the proposed congress is being projected.

As brought out at the meeting the problem of education for industry involves three grades or ranks of persons; engineers or higher executives, foremen or minor executives and workmen. The character and magnitude of the educational problems involving each of these three classes was developed by Mr. Alford.

The meeting voted to recommend to participating organizations that a congress be held, that the scope of the congress be referred to an executive committee with a recommendation that it be a delegate conference, and that matters as to date and place for the congress be referred to the executive committee. It was provided that this committee should consist of five men to be appointed by the chairman from the organizations represented at the meeting.

American Engineers in Argentine to Organize

MEMBERS of member-societies of the Federated American Engineering Societies in the Argentine are planning the formation of an American engineering society to include all American engineers. The secretary of our Society has been requested to furnish Wallace R. Lee, c/o Baldwin Locomotive Works, Paseo Colon, 185, Buenos Aires, Argentine, a list of the members of our Society resident in Argentine; the Secretary has also been requested to have a representative of this Society appointed in Buenos Aires or elsewhere in the Argentine to communicate with Mr. Lee.

This movement will not only be a beneficial one to the American engineering societies involved but to the engineering profession at large, and the purpose of this notice is to call the attention of those members in the Argentine to the proposed formation of American engineering societies there.

Licensing Engineers

AT THE executive board meeting of the American Engineering Council of the Federated American Engineering Societies held in St. Louis, June 3, a resolution was passed requesting the committee on the licensing of engineers to hold a hearing in the near future, at which time all interested might present their views as to the licensing of engineers. The chairman of the licensing committee is now developing plans for such a hearing, the time and place to be announced latre. In the meantime, the committee desires to get in touch with all those who are interested and obtain from them a written statement as to their views concerning the several phases of the licensing of engineers.

Inasmuch as many of the members of the American Society of Agricultural Engineers have been and are now very much interested in the matter, the committee on licensing of engineers would appreciate receiving from them such a written statement as they desire to make on the subject. The Secretary of our Society is requested to send the committee a list of those A. S. A. E. members that should be invited to the hearing or should receive special notice. Any A. S. A. E. member who wishes to be present at the hearing is requested to advise the Secretary, Frank P. Hanson, at once, and also if you desire to submit a written statement on your views concerning the licensing of engineers this should be done promptly and mailed to L. W. Wallace, executive secretary, The Federated American Engineering Societies, 719 Fifteenth Street, N. W. Washington, D. C.

New Members of the Society

Members

George N. Allen, general superintendent, Walter A. Wood Mowing & Reaping Machine Company, Hoosick Falls, New York.

Harry H. Bates, Secretary, Bates Machine & Tractor Co., Joliet, Illinois.

Wm. Lincoln Rockwell, consulting irrigation engineer, Austin, Texas.

Charles Edward Stoddard, engineer, Farmer's Independent Thresher Company, Springfield, Illinois.

Associate Members

Robert W. Coffey, concrete and surfacing inspector, State Highway Commission, Granada, Colorado.

Affiliate Members

Ralph Herman Denman, assistant professor of rural engineering, Massachusetts Agricultural College, Amherst, Massachusetts.

Harry Elden Orr, manager territorial department, Cleveland Tractor Company, Cleveland, Ohio.

Frederick C. Warne, agricultural engineer and designer, Roderick Lean Manufacturing Company, Mansfield, Ohio.

Junior Members

C. L. Osterberger, coordinator federal board and teacher of farm mechanics, Louisiana State University, Baton Rouge, Louisiana.

Changes in Membership Grade

Frank K. Baxter, salesman, J. I. Case Company, Kansas City, Missouri. (Student to Associate Member).

Roy G. Cullen, Isle Street, George, Ohio. (Student to Junior Member).

David Fette, farming, R. F. D. No. 2, Hannibal, Missouri. (Affiliate Member).

Applicants for Membership

The following is a list of applicants for membership received since the publication of the July issue of Agricultural Engineering. Members of the Society are urged to send pertinent information relative to the applicants for consideration of the Council prior to their election.

Horace Lilburn Smith, Jr., associated with Horace L. Smith, Sr., manufacturers, Petersburg, Virginia.

John Staley Glenn, assistant instructor, Virginia Polytechnic Institute, Blacksburg, Virginia.

Joseph P. Fulmer, farmer and dealer, Nazareth, Pennsylvania.

Max E. Cook, farmstead engineer, Land Settlement Board, Delhi, California.

Henry Bradley Boynton, assistant instructor, Virginia Polytechnic Institute, Blacksburg, Virginia.

Nelson Beem, farming, Summit Station, Ohio.

Leslie Webb Symmes, agricultural engineer, and director of Leslie Symmes and Associates, Engineers, Holbrook Building, San Francisco, California.

John D. Runte, chief inspector, Emerson-Brantingham Implement Company, Rockford, Illinois.

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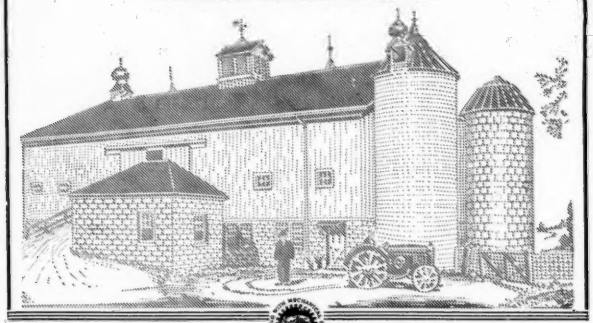

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